CAMBERED LIQUID CRYSTAL DISPLAY PANEL

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the priority benefit of Taiwan application serial no. 98116404, filed on May 18, 2009. The entirety of the above-mentioned patent application is hereby incorporated by reference herein and made a part of specification.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a cambered liquid crystal display panel. More particularly, the present invention relates to a cambered liquid crystal display panel that photo-spacers therein may have different distribution densities or different gaps can be formed between the photo-spacers and opposite substrate.

2. Description of Related Art

Generally, a liquid crystal display (LCD) panel used in a LCD apparatus includes an active array substrate, a color filter substrate and a liquid crystal layer disposed there between, wherein the two substrates are generally bonded by a sealant to seal the liquid crystal layer there between. To maintain a cell gap between the two substrates, photo-spacers are generally formed on the active array substrate or the color filter substrate, and then the active array substrate and the color filter substrate are assembled and liquid crystal is filled there between to form the LCD panel. To ensure a display quality of the LCD apparatus, maintenance of the cell gap is a very important issue, and if uniformity of the cell gap is not properly maintained, a display mura phenomenon is occurred.

Recently, cambered LCD panels are applied to electronic products having a cambered appearance, and in the cambered LCD panel, variation of the cell gap is one of the concerned issues during fabrication.

FIG. **1** is a cross-sectional view of a conventional cambered LCD panel. Referring to FIG. **1**, the conventional cambered LCD panel **100** is formed by a first substrate **110**, a second substrate **120**, a sealant (not shown) and a liquid crystal layer **130**, wherein a cell gap Gc close to a top A of a cambered structure is less than a cell gap Gs apart from the top A of the cambered structure, so that liquid crystal molecules in the liquid crystal layer **130** are pushed apart from the top A of the cambered structure, which may lead to uneven distribution of the liquid crystal molecules and cause the display mura, and accordingly the display quality of the LCD panel is deteriorated. Therefore, the above-mentioned problem is one of the major problems to be resolved for fabricating the cambered LCD panel.

SUMMARY OF THE INVENTION

The present invention is directed to a cambered liquid crystal display (LCD) panel capable of maintaining a cell gap through adjusting gaps between photo-spacers and opposite substrate or adjusting a distribution density of the photo-spacers.

The present invention provides a cambered LCD panel including a first substrate, a second substrate, a sealant, a plurality of photo-spacers and a liquid crystal layer. The sealant is disposed between the first substrate and the second substrate, and the first substrate, the second substrate and the sealant are bent to form at least one cambered structure. The photo-spacers are disposed on the first substrate and distributed between the first and the second substrate, wherein a gap formed between a part of the photo-spacers close to a top of the cambered structure and the second substrate is smaller than a gap formed between a part of the photo-spacers apart from the top of the cambered structure and the second substrate. The liquid crystal layer is disposed between the first substrate and the second substrate, wherein the photo-spacers and the liquid crystal layer are surrounded by the sealant.

In an embodiment of the present invention, the first substrate has a first region corresponding to the top of the cambered structure and at least a second region located at one side of the first region. The photo-spacers include a plurality of first photo-spacers and a plurality of second photo-spacers, wherein the first photo-spacers are disposed in the first region, and a gap between each of the first photo-spacers and the second substrate is G**1**. The second photo-spacers are disposed in the second region, and a gap between each of the second photo-spacers and the second substrate is G**2**, wherein G**1**<G**2**.

In an embodiment of the present invention, the first substrate further has at least one third region located at another side of the first region, and the photo-spacers further include a plurality of third photo-spacers disposed in the third region. A gap between each of the third photo-spacers and the second substrate is G**3**, wherein G**1**<G**3**.

The present invention provides a cambered LCD panel including a first substrate, a second substrate, a sealant, a plurality of photo-spacers and a liquid crystal layer. The sealant is disposed between the first substrate and the second substrate, and the first substrate, the second substrate and the sealant are bent to form at least one cambered structure. The photo-spacers are disposed on the first substrate and distributed between the first and the second substrate, wherein a distribution density of a part of the photo-spacers close to a top of the cambered structure is greater than a distribution density of a part of the photo-spacers apart from the top of the cambered structure. The liquid crystal layer is disposed between the first substrate and the second substrate, wherein the photo-spacers and the liquid crystal layer are surrounded by the sealant.

In an embodiment of the present invention, the first substrate has a first region corresponding to the top of the cambered structure and at least a second region located at one side of the first region. The photo-spacers include a plurality of first photo-spacers and a plurality of second photo-spacers, wherein the first photo-spacers are disposed in the first region, and a distribution density of each of the first photo-spacers is D**1**. The second photo-spacers are disposed in the second region, and a distribution density of each of the second photo-spacers is D**2**, wherein |D**1**/D**2**| is between about 1.125 and about 20.

In an embodiment of the present invention, the first substrate further has at least one third region located at another side of the first region, and the photo-spacers further include a plurality of third photo-spacers disposed in the third region. A distribution density of each of the third photo-spacers is D**3**, wherein D**1**>D**3**, and |D**1**/D**3**| is between about 1.125 and about 20.

As described above, by adjusting the gaps between the photo-spacers and the opposite substrate, a gap between the photo-spacers close to the top of the cambered structure and the opposite substrate is adjusted to be smaller than a gap between the photo-spacers apart from the top of the cambered structure and the opposite substrate, so as to maintain the cell gap of the cambered LCD panel. In the present invention, by